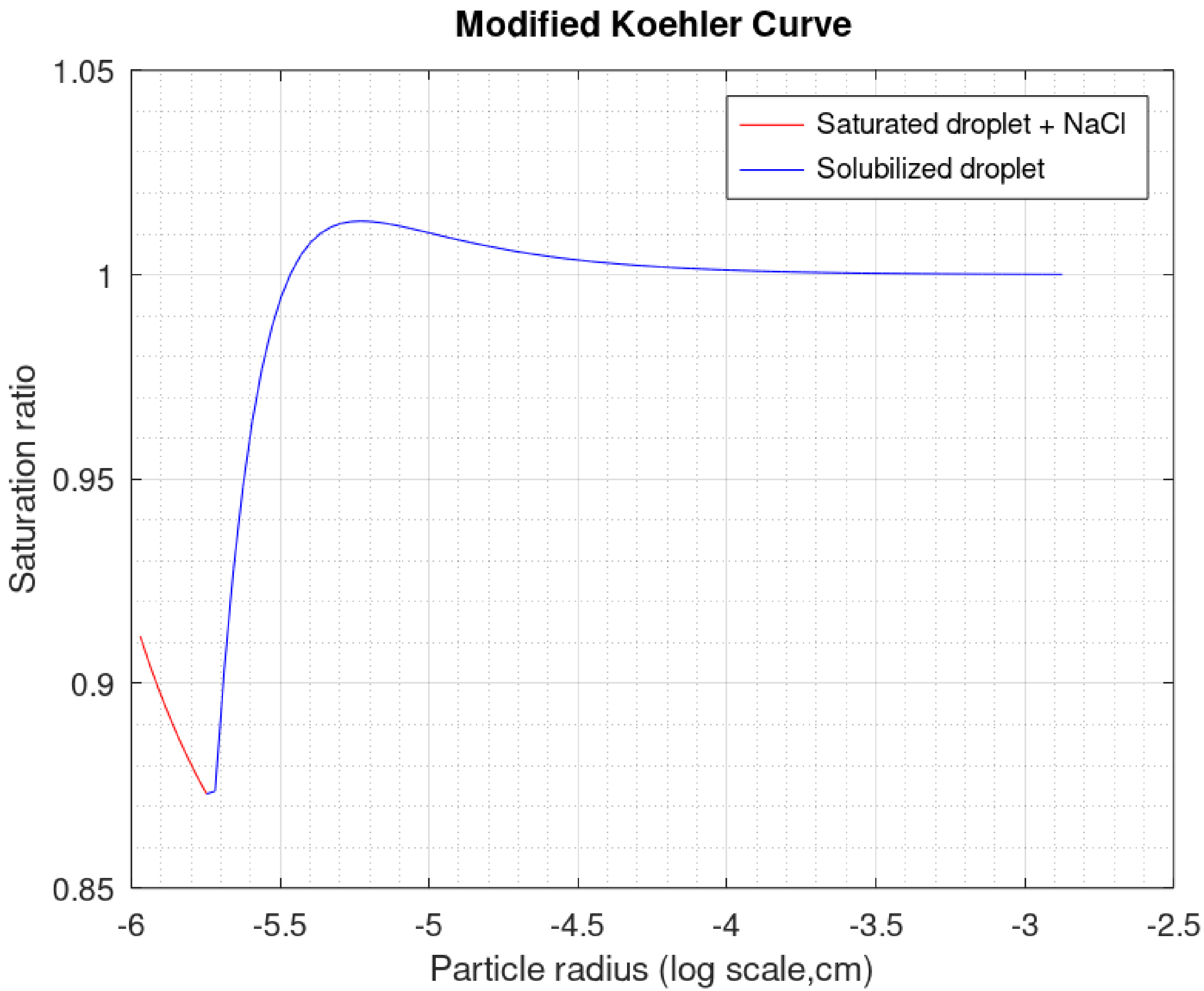
Koehler curve (see wikipedia 'Koehler theory') does not account for the formation of a saturated salt solution in the aerosol droplet.
Moreover it employs a simplified Raoult equation , not suited for concentrated solutions and uses other unnecessary simplifications.
This simulation is on the contrary starts from a dry aerosol particle (in this example solid NaCl) and considers the growth of the particle by water condensation. The red curve refers to a saturated solution , while the blue to completely solubilized NaCl in the droplet.



```
clc;clear all;format short;format compact;
R = 8.314472;    % Gas Constant
T = 273;         % Temperature in (K)
load -binary 'interp.bin' m;
Ppure = exp(polyval(m(:,4),T)); % vapor pressure of pure liquid water at the temperature 'T'
Ppure
r1 = 1e-6 ; % dry aerosol particle radius (cm)
            % NaCl mass therein contained is 9.09*r1^3 (grams)
            % 'm' is the mass of water forming the solution around the particle
            % being solubility for NaCl 36g in 100 ml H2O the mass of saturated solution
            % around the particle is '1.36*m' and the amount of solubilized NaCl is '0.36*m'
            % being 2.17 the density (g/cm^3) of solid Nacl and 1.202 the density of saturated solution we have :
i = 0;ti = 0;
for m = logspace(-18,-8,100); % 'm' is the mass of water forming the solution around the particle
  ++i;
  if m < (25.25*r1^3)
    ++ti;
    %disp('saturated')
    Va = (10.93*r1^3 + 2.518*m)/2.608; % 'Va' is the volume of the aerosol particle
    r2 = (3*Va/4/pi)^(1/3); % 'r2' is the wet aerosol particle radius (cm)
    NaCl = 0.36*m; % 'NaCl' is the mass of dissolved NaCl in water around the particle
    % ---------> All the above holds if the solution is saturated in NaCl, until there is still some
    % NaCl inside the particle, (9.09*r1^3 - 0.36*m)>=0; m<= (25.25*r1^3) (g)
    % when m>(25.25*r1^3) then we apply the Koehler equation, being the NaCl solution no more saturated
    % on assuming linear variation of the density of NaCl solution with concentration we have
  else
    %disp('koehler')
    dens = 5.1*r1^3/m + 1; % 'dens' is the density of the aerosol particle, now moniphasic (g/cm^3)
    Va = (9.09*r1^3 + m)/dens; % Va is the volume of the particle, now monophasic
    r2 = (3*Va/4/pi)^(1/3);
    NaCl = 9.09*r1^3;
  end

  % now we spot the Raoult equation (see wikipedia for example)
  molefractionH2O = (m/18)/(m/18 + 2*NaCl/58.44); % H2O=18 ; NaCl = 58.44  molecular weights ; i(van't Hoff) = 2
  Pvap = Ppure*molefractionH2O;

  % now we spot the Kelvin equation (see wikipedia ---> ln(P/Pvap) =2*gamma*Vm/(r2*R*T)   )
  P(i) = Pvap * exp(2*100*0.0728*18e-6/(r2*R*T)); % (r2 in (cm), all the other in S.I. units)
  radius(i) = log10(r2);
end
```

```
plot(radius(1:ti),P(1:ti)./Ppure,'r',radius(ti:end),P(ti:end)./Ppure,'b');grid on; grid minor on;
xlabel("Particle radius (log scale,cm)");
ylabel("Saturation ratio");
title('Modified Koehler Curve');
legend('Saturated droplet + NaCl','Solubilized droplet')
```